Architecture Governance

The IT architecture will be reviewed when business events warrant and/or annually for business alignment.

Rationale
Business and technology are changing rapidly. For these changes to be reflected in the IT architecture, there must be a well-defined process in place to ensure the continual re-examination and alignment of the business and IT strategy.

Implications
- The State will utilize a disciplined and structured process to maintain and refresh its IT architecture. This structured process will include a configuration management process, an information distribution process and supporting tools.

- Near-term and long range strategic planning will be performed jointly by the business units and IT to ensure coordination of effort, timeliness and to begin the annual update of the IT architecture.

- The architecture will be reviewed on an 'event' basis when warranted by business or industry change.
- The State's employees will be utilized as primary resources for the creation, refreshment and maintenance of the architecture to ensure business fidelity and to provide governance over related outsourcer activities.
- Technologies and standards will be retired when they are no longer useful or its long-range plans.

The information systems and technology infrastructure implemented by the state will be compliant with the IT Architecture.

Rationale
In order for the state to create an IT environment for the future and to realize the benefits of a standards-based enterprise architecture, all information technology investments must be reviewed to ensure compliance with the established IT architecture.

Implications
- A structured investment review process will ensure that information systems comply with the IT Architecture and related standards.
- Processes must be developed for all application procurement, development, design, and management incorporating the principles of this architecture.
- To ensure that its benefits are maximized, new technology will be incorporated into the architecture and associated standards under the supervision of this process.

Governed Evolution and Infrastructure Reuse

Rationale

Establishing an adaptive IT architecture involves change for people, process and technology. By planning evolutionary change and implementing reusable elements, the architecture will permit consistent integration between applications, increase the overall adaptability of the IT environment, increase the speed of solution delivery and maximize IT investments.

Implications

- Short term vs. long term benefits will be examined for each project or technology implementation.

- Dependencies across IT initiatives will be developed in order to time technology implementations for maximum benefit across The state and to prioritize IT initiatives.

- The *Architecture and Standards Infrastructure development* (ID) team will deliver reusable infrastructure services for all business solutions. This will reduce the time spent by solution developers for infrastructure development and will create re-usable infrastructure elements that are not isolated to current project or platform requirements.

- Solution designs must conform to the use of standard infrastructure services.

- The state will need to collaborate and coordinate its plan both internally and externally.

Architecture Principles and Suggested Practices

Architecture Principles and Suggested Practices are the architectural guidelines specific to The State's environment that guide investment and design decision-making. They guide decision-making by defining how The state should implement technology to maximize business benefit, while maximizing the adaptability of the IT environment.

A *principle* is a design guideline that should be followed by all decision-makers in the enterprise. Principles must be adhered to by all decision-makers to ensure that the long-term goals of the architecture and of the state are achieved.

A *suggested practice* is a design guideline, but it differs from a principle in its enforcement. This difference does not suggest that the guideline is less important, it only suggests that some areas of the state are not prepared to implement the guideline due to technological or organizational limitations. Suggested practices have the potential of becoming a principle in the next two to three years. They should be implemented whenever possible.

UNIVERSAL DESIGN PRINCIPLES AND SUGGESTED PRACTICES

1.   Streamlining business operations shall take precedence over automation.

Business processes shall be improved by eliminating and simplifying current systems and processes. These efforts shall take precedence over information systems automation.

Implications:

- A disciplined change management and systems development methodology will need to be followed to maximize potential for success in reengineering efforts.
- All projects will perform business process analysis and consider process improvements as part of their standard project plan. This will require additional time and resources to be invested early in the systems development life-cycle.
- Administrative, tactical and/or non-strategic applications will be chosen based on criteria that apply to all like roles in the corporation. This will reduce the number of unique solutions for common problems and encourage process redesign.

- Change management and potentially painful organizational change will be required to implement reengineered work processes.
- Greater benefits will be obtained in the end by improving business processes, but these benefits will be deferred due to the need for increased analysis up front and the implementation of required organizational change.

2.   Common systems shall be used.

Information systems shall be common among business segments and staff organizations unless a compelling business reason requires them to be unique. This will allow The State to achieve the lowest life-cycle costs by re-using business solutions and providing common support and services.

Implications:

- Tactical solutions, or those implemented for competitive parity, shall be optimized for enterprise-wide applicability. (Plan within projects for corporate or global IT optimizations rather than project or local IT optimizations).

- Business systems and databases will be organized according to subject matter, not by department, division or business unit.

- IT will pursue outsourcing of non-strategic IT support services or non-core Business Unit technologies.

- Strategic support services will be centrally managed and structured to support the business, with preference given to a co-located organization.
- Applications that are common to business units will be centrally acquired or developed.
- Acquisition costs will be minimized through State-Wide purchasing.

3. Technologies and Solutions Will Give Preference to Commercially Available Products.

Commercial off the shelf (COTS) products shall be used to facilitate improved processes, as established by the process owners. They shall be preferred over custom developed software. Customization of COTS packages shall be allowed only by exception and after review by the Executive Committee.

Implications:
- Recommendations for solution investigations will be provided according to the following priorities: (1) Commercially available solution; (2) Customizations to a commercially available solution; (3) Custom development.

4. The number of product permutations will be limited to facilitate integration, simplify support efforts and reduce long-term costs.

Rationale
In the absence of major business advantage, deploying multiple products that deliver similar functionality needlessly increases complexity and cost. By limiting the number of technologies and creating a more consistent environment, The state will optimize the cost for implementing, supporting and maintaining the IT environment.
Furthermore, the IT environment adapts more quickly to business change by reducing the time spent on technology transition and implementation. This is achieved by reducing the number of technology permutations to consider during the planning process and thereby simplifying the integration of new functionality.

Implications
- Broader requirements gathering will be required when investigating new technologies to consider the requirements of the greater community of potential users.
- Transition plans will need to be created for technologies that no longer provide sufficient functionality or are costly to manage and support. These technologies will be retired and their functions transitioned to the new common services.

- Cost analysis should include the recognition of costs for new technology introduction (i.e. Implementation, retirement, user/IT staff training, support and maintenance cost)
- Product licensing agreements should allow broad implementation of the product and identify the cost savings for enterprise-wide versus niche implementation.

5. Enterprise information systems integration/interoperability shall be viewed as an essential competitive strategy.

Interoperability and Standards decisions will be based on interoperability and maintainability and will apply to both procurement and support. Standards will be strategically conservative, with priority placed on interoperability instead of selecting

point in time best of breed products. Yet, interoperability should be maximized while retaining the ability of choice between vendors

Implications:
- The Executive Committee shall oversee the development of the IT Strategic Plan to ensure integration and interoperability.
- Products should be compliant with selected International, National, or Industry Standard Specifications whenever possible.
- Interoperability should be managed aggressively, especially where the long-term benefit is clear. (Supply Chain, Electronic commerce, Engineering collaboration)

6.   Buy before you build.

We should *"build"* those applications that will provide competitive advantage and *"buy"* those applications that will provide competitive parity.

Rationale

Use of packaged solutions is increasing and will continue to increase
Since packaged solutions are available to the competition; we cannot sustain competitive advantage.
Areas that provide competitive advantage are likely areas in which quick adaptation is required. This requires in-house, not vendor, responsibility.
Differentiation, not operational excellence, is the competitive advantage for most market leaders.

Implications
- Must identify the areas in which the business is seeking competitive advantage.

- Invest in the skills, tools, and technology for custom development in the areas that will gain competitive advantage.

- These areas are increasingly becoming information delivery and decision support, rather than operations and transaction.

7.   Appropriate Geographic Partitioning

Applications and databases should be *geographically partitioned* so that services are consolidated and co-located within a Metropolitan area. Consolidation and co-location at an enterprise-level should be evaluated to determine if bandwidth, performance and support service levels could be met without sacrificing the desired reliability service level.

Rationale

Network bandwidth is abundant within the metropolitan area (post-ORION) and is available without the premium of wide-area communications. This makes it possible for applications and services to be co-located without sacrificing the performance or reliability of the application, and yet save costs for operations, support and other application management issues.
However, the wide-area network does not have low enough cost to automatically consider wide-area consolidation as the norm. (Trends in communication costs suggest that this is changing rapidly and will be possible within the next several years).

Implications
- Projects should consider wide-area consolidation and balance wide-area bandwidth costs against reliability, performance and support service levels.

- The costs of wide-area communications should be monitored and this principle changed to "wide-area consolidation' once the costs of wide-area communications make this possible.
- Must maintain configuration discipline remotely to manage consolidated applications.

8.   Interoperability with customers or business partners is preferable to the enforcement of industry standards or internal standards.

Rationale

To facilitate partnering and collaboration with other companies/industries, designs should bias their decisions toward customer and business partner interaction.

Implications

- The state should encourage standardized approaches with customer's and business partners to minimize uniqueness and its associated costs.
- Some solutions involving business partners or customers may use "non-standard" mechanisms.

Suggested Practices

9.   Firm Logical Boundaries with Message-based Interfaces

Logical boundaries must be established between the partitions, application or database, and the logical boundaries must *not be violated*.
 (The actual physical partitioning of the applications and the partitioning of the databases may be different.)

Rationale

Traditional solution development methods have created innate dependencies between solutions by explicitly binding their internal logic, platforms, or structures. This causes unnecessary change within these solutions when a change to the internal logic, platforms, or structures of one solution forces a change in all associated solutions. This innate dependency can be avoided by creating these inviolate logical boundaries.
Once the logical boundaries are established, the mechanism used to request its services should be a standard 'message' that can be used a more general-purpose interface for its services.

Implications

- The interfaces across separate logical boundaries must be *message-based* and extend across the value chain to both customers and suppliers.
- A common messaging infrastructure needs to be established.
- Common messaging formats, IDs, and standards must be established.
- Applications must be designed to be event-driven and application developers trained to use messaging and other event-driven programming techniques.
- Data access should be performed using a "business object" that hides the data access method so that the method can be easily changed in the future without a major impact on the applications that utilize the business object.

10. Create an Event-driven Systems Environment

Rationale

Business processes are a series of business events where change involves adding/removing/changing the underlying business events. By designing systems to perform an action when a business event occurs, allows the event to be processed like a simulation of the actual business environment.

Event-driven systems design increases the entire IT environment's adaptability by enabling response times to be shortened simply by processing the event more quickly, and not requiring a redesign of the component that is processing the event.

Implications

- Systemic thinking should replace "silo" thinking so that business processes can be adapted as the business environment changes.
- Analysts and designers will need to create infrastructure and business solutions that can easily adapt to changes in business events.

DOMAIN DESIGN PRINCIPLES

1. Applications will be designed to promote modularity, reusability of sub-assemblies, and shared components.

Rationale
Reuse will lower costs and maintenance efforts.
Building components is not enough; they must be used to gain any benefits.
The scope of reuse must be broad to recognize the greatest potential.

Implications
- Create application interfaces for general-purpose use.
- Implement business rules in a non-proprietary, cross-platform language.
    - Component management must become a core competency utilizing a repository for components to promote change management.
    - Adapting to the State's multiple geographic requirements and taking advantage of distributed processing powers will require applications to be deployed on geographically dispersed servers.

- Must develop a culture of reuse because culture is tied to behavior modification, which is tied to reward/compensation for desired behavior.

2. Human factors will be considered in all designs.

Rationale
See the Universal Design Principle: "Common systems shall be used"

Implications
- Systems will be designed with common look and feel.
- Application user-interface standards will be created and used by all development teams.
- Must develop a culture of reuse because culture is tied to behavior modification, which is tied to reward/compensation for desired behavior.

3. Inter-application and intra-application communication interfaces should be designed to permit batch, near real-time or real-time processing of the requests.

Rationale
See the Universal Design Principle: "Create an Event-driven Systems Environment"

Implications
- Implement business rules as discrete executable components or services that can be executed independently.
- Applications management should enable the reliable execution and restart of services, and the ability to utilize multiple instances of the same service.
- Use Transaction Processing Monitors when > 100's of transaction per second; large concurrent user population.
- Use a CORBA compliant Object Request Broker between tiers of a distributed object application for communication.

- To update a legacy system, use Message-oriented middleware to receive requests on behalf of the legacy system, instead of file-based transfers.

Suggested Practices

4.   Application Partitioning

The logical design of application systems should be highly partitioned into discrete service layers using an N-tier model.
Rationale
A change in data organization or other integrated business solutions can potentially affect a large number of programs/application services if they are not highly partitioned. Partitioning isolates/minimizes the impact of the change and reduces the time for modifying and re-testing a system.
Implications
- An application should divide coded entities into multiple layers: Presentation; Process Request; Request Processing; Data Request; and Data Access
- Management of source code will increase due to the increased number of (better-defined) coded entities.

5.   Object-Oriented

Application delivery should be evolving toward an object-oriented approach.
Rationale
Objects will allow for easier adaptation of business process changes.
ISVs (independent software vendors) will progress from components to objects
Implications
- Component development is the logical, and practical, evolutionary step toward objects.
- A fundamental knowledge of objects must be obtained.
- Object trends must be watched.
- Don't miss the maturity toward objects.

6.   Information and Data shall be managed as a State asset.

Information and the data from which it is derived is a State resource and shall be consistent, easily accessible, and able to be shared by all authorized users. It should be accessible from any desktop or remote location through a common user interface and be safeguarded from unintentional or unauthorized alteration, destruction, or disclosure.

Rationale

Information is a valued *enterprise asset* that should be leveraged across the information value chain to enhance competitive advantage and accelerate decision-making. This helps the organization shrink business process cycle times and increase the integrity and relevance of data across the state.

Implications

- Define and identify stewards ("Owners" - managers) for data and information.

- Security of databases will adhere to the existing Security Policy.
- Establish an information sharing policy for the enterprise.
- Create and maintain a repository for the formal names and the comprehensive definitions of data, information and its business meaning.

- Database designs, data naming and data display must comply with the enterprise data model.
- The enterprise will have a Meta-data repository where data relationships are defined, published, and easily accessible.

- The meta-data repository must be actively maintained using common repository tools for the maintenance of federated and warehouse meta-data.
- Need to establish one authoritative or master source for data with replicate reference copies created to increase usability or performance.
- Duplicate and inconsistent copies of data must be identified and eliminated through a migration process where application references are modified to use the single master copy. This will be planned for as part of application upgrades or new implementations.
- To accelerate the velocity of information, data warehouses may need to be developed to facilitate information availability for decision-making.
- Access to databases will be designed as defined "units of work" that ensure that all updates are successfully applied or that none of the changes affect the source in case of an error. (transactions with commit and roll-back)

7. Separate Operational Data from Data Used for Analysis and Historical Reference.

Rationale

Operational systems provide the day-to-day functionality required for the processing of business data and transactions. The growth for these systems is incremental, and their requirements are predictable.

However, the data, systems and applications used for analytical purposes need to be organized and designed to handle the range of immediate to more scheduled interactions. This is due to:

- The difficulty in predicting the non-linear growth for data that is used for analytical study and other forms of "what-if" or historical analysis.

- The necessity to organize data by date, time and topic, as opposed to a 'function-oriented' organization; and

- The need to integrate data across business processes and functions.

Implications

- Need to develop and implement a State-wide Data Warehousing strategy describing the benefits, the plan and the approach for managing the enterprise's analytical data.
- Need to develop Data warehouse and data mart system and application standards for deployment of common decision-making abilities throughout the enterprise

8. Leverage the data warehouse to accelerate decision-making and reduce the development burden.

Rationale

Reduced cycle times have led to a need for accelerated decision-making and a need for more information access.

There is a significant burden on programmers to generate reports and data queries. Data warehouses and their associated end-user tools make it possible to relieve this burden by making it the responsibility of end users.

Implications

- Programmers have more time for development tasks; IT is still involved.
- Data warehouses, data marts and easy to use end-user tools are needed.
- End users become more knowledgeable about information and the skills acquired by using the analysis and decision-making tools can be leveraged in multiple business solutions.

9. Server Partitioning – "Workloads"

Applications and databases should be *physically partitioned* on separate servers, in the same location, based on workload.

Rationale

Server configuration (processors, memory, storage, etc.) is based largely on the expected volume and type of work. By configuring servers for similar processing, the load can be distributed across multiple, similarly configured, servers as process workloads change.

Furthermore, by partitioning the workloads across multiple, more specialized, servers, the availability of the solution to the business community increases by having built-in redundancy.

Implications

- Applications and data access services with unpredictable or unique workloads should be partitioned to their own server. This includes Web, e-mail, imaging, and data warehouse/data mart applications.
- Applications and data access services with similar workloads can be deployed on the same server.
- Need to develop server configurations to handle a (limited) variety of workloads and yet, maintain configuration discipline, trading capital dollars for support dollars.
- Utilize hardware that is binary compatible so that work loads can be adjusted between servers.

10. Minimize the number of platform configurations.

Limit the continuous performance tuning of servers, desktops and other platform components by creating a collection of standard configurations to be deployed across the enterprise.

Rationale

Today, the cost of IT personnel is increasing due to a shortage of skilled resources, while the cost of hardware is decreasing rapidly. Therefore, it is suggested that a limited number of platform configurations be engineered and tuned once, not continuously, to offset the increasing personnel costs. Multitudes of unique configurations are created by constantly 'tweaking' the performance of an individual server or desktop computer. This increases support and maintenance cost by requiring support personnel to understand each unique configuration and to implement future changes for each configuration.

Implications

- Increase capital investment when it offsets long-term support costs by purchasing hardware that exceeds the immediate need to reduce the need for performance tuning and promote expandability of the base configuration. (e.g. servers with extra expansion capability to allow upgrading at remote locations)
- Plan to replace multiple, non-standard, configurations with a small number of consistent configurations.
- Plan for the regular replacement of platform components to ensure the retirement of obsolete and unique configurations.
- Deploy applications on a (multiple) uniformly configured server(s).

11.   Minimize dependency on a particular client platform as much as possible.

Rationale

With the ubiquity of network communications and the continual reduction of networking costs, the trend is toward network-based computing services being accessed by a variety of client platforms (desktop, remote, handheld). To permit The State's participation in this trend the reliance on the services of the client platform must be minimized.

Implications

- Web browsers should be considered as an application interface for their support of multiple platforms.

- Design applications for reuse by different client platforms (See *Applications will be designed to promote modularity, reusability of sub-assemblies, and shared components* in the Application Domain.)

12. Enterprise Network as Virtual LAN

We must implement an enterprise-wide backbone network that provides a "single network image" as if it were a virtual, enterprise-wide Local Area Network (LAN).

Rationale

The state increasingly relies on its communications networks for business operation. As the cost of communications decreases, this reliance will increase. This is demonstrated by an increasing need for access to information across the enterprise for which networks are an essential enabling technology.

To reduce decision-making cycle times and to enable the use of common solutions, access to these resources must be seamless so users can access the resource in a similar manner regardless of location.

Implications

- Ensure the availability of the network seven days a week and twenty-four hours a day.
- The network should be designed to handle a variety of data types, including voice, application data, image, engineering, video and other business data.
- Bandwidth needs should be monitored and services adjusted to accommodate new and expanding business demands.
- The LANs distributed across The State should be re-designed using standard network configurations and interconnected through the Wide-area network.
- Base all network designs on common, open, and secure protocols.
- Provide unified directory and security services across The State.
- The network must be designed to minimize latency, so that data is delivered in a timely manner.

1. The security of the entire IT environment will be managed aggressively.

Rationale

The state's business requires the implementation of multiple security policies, including policies for sensitive unclassified information and multiple categories of classified information. This diverse set of requirements will be addressed through a common process and through the implementation of common mechanisms to ensure compliance with State, governmental and international security policies. However, the cost-effective implementation of secure communications environments should not preclude the use of outsourced or public carrier communications services.

Implications

- Security features implemented will be consistent across all applications. Consistency in the security interfaces and naming procedures will aid in managing sensitive data by reducing errors and lowering training costs for multiple security implementations.

- Security information will be presented to users in a common format.
- Separate or dedicated security systems and approaches will be reduced or eliminated.
- The security mechanisms implemented will allow the use of private and/or public communications mechanisms.

13. Systems must be configured to facilitate remote management and support.

Rationale
The state will be deploying solutions to metropolitan areas and remote sites that will need the same level of service provided as that are centralized. In order to minimize the support costs of these non-centralized services, the support capability will need to be performed remotely rather than with a dedicated, onsite staff. Furthermore, as some of these support services are outsourced to external service providers, it will be required to minimize contracted service costs.

Implications
- Configure remote services to prevent a single point of failure.
- Secure decentralized services in a virtual data center.
- Include standard systems management functions in all systems configurations (see *Minimize the number of platform configurations* in the Platform domain)
- Provide common, remote, software distribution services.
- Perform remote backup, archiving and recovery of data.
- Solution components will be proactively monitored and provide advance warning of failures.

- Asset management activities must include actively updating hardware and software inventories and configurations installed at any given site.

North Carolina Architecture Mission

Architecture Component	Mission
Application	Identifies criteria and techniques associated with the design of applications which facilitate easy modification in order to quickly respond to the state's business needs.
Network	Defines a common, uniform network infrastructure in order to provide reliable and ubiquitous communication for the state's distributed processing environment.
Data	Provides requirements to ensure high quality, consistent data for on-line transaction processing (OLTP).
Componentware	Enables efficient reuse of existing application assets by establishing common, reusable business rules. This results in faster deployment of new applications, reduced maintenance of business rules, and improved responsiveness to business changes.
Application Communication Middleware	Facilitates and simplifies communication between distributed applications. A standard service broker provides a consistent mechanism for applications to use common, reusable business rule components.
Groupware	Establishes a foundation for the sharing of work and information among individuals and workgroups within the state.
Information	Provides standards for accessing data for on-line analytical processing (OLAP), including executive information systems (EIS) and decision support systems (DSS).
Platform	Identifies ìopenî hardware platforms and associated operating systems supporting an N-tier client/server application architecture.
Integration	Maximizes investment in legacy systems by specifying transition strategies so they can work effectively with more modern applications. Also specifies how to integrate purchased

	application packages.
Systems Management	Defines the framework for efficient and effective management of the state's distributed information processing environment.

Arizona

Enterprise Architecture (EA) describes a comprehensive framework for information technology and business that supports the Arizona State government strategic plan. EA facilitates the application of information technology (IT) to business initiatives and objectives and aids subsequent change in an orderly, efficient manner by describing a direction for current and future activities, supported by underlying principles, standards, and best practices.

EA effectively supports and enhances the business of government and improves the ability to deliver responsive, cost-effective government functions and services. Effective utilization of technology to achieve business functions and services, increasing citizen access to those services, sharing information and resources at all levels of government, and maximizing investment in IT resources are major motivating factors for the development and implementation of EA.

Connecticut

The Business and IT Strategy Board exists to ensure the alignment of IT with the business requirements of the State and its agencies. This group verifies the Common Requirements Vision (PDF 36K)and approves the Conceptual Architecture Principles (PDF 54K) of the EWTA. The board works with the Architecture Team to keep the Requirements for Technical Architecture and the Conceptual Architecture Principles current with the business needs of the State. They provide important advice and support for new statewide IT initiatives and policies, as well as adjudicate final appeals for exceptions to architecture standards.

Texas

The ACE Steering Committee serves as the principal forum for information technology (IT) guidance within the State of Texas to share effective IT management practices and information nature and to establish a statewide enterprise architecture with IT policies, procedures and practices.

The purpose of the ACE Steering Committee is to facilitate information exchange among State agency Chief Information Officers regarding the application of IT to support the functional direction of the State.

The ACE Steering Committee shall oversee, approve and/or disapprove the general direction and application of information technology resources and services within state government.

The ACE Steering Committee shall provide advice for state IT needs, direction and standards for consideration by the Department of Information Resources (DIR) Board.

The role of the ACE Steering Committee is to participate proactively in the development and implementation of IT policy and to provide a forum for cooperative efforts and information exchange for the IT staff of State agencies.

The ACE Steering Committee may develop Subcommittees to consult and advise the ACE Steering Committee on business practices; and suggest technology domains and standards for those domains where appropriate.